Intelligent Drive next LEVEL
on the way towards autonomous driving

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Mercedes-Benz
Das Beste oder nichts.
Pioneers of Safety Features: Safety with Tradition

- 1959: Crumple Zone
- 1980: Airbag, Seat-Belt Tensioner
- 1995: Electronic Stability Program (ESP®)
- 1998: DISTRONIC
- 1996: Brake Assist System (BAS)
- 2002: PRE-SAFE®
- 2006: PRE-SAFE® Brake
- 2009: Speed Limit Assist, ATTENTION ASSIST, Lane Keeping Assist and Adaptive Upper Beam Assist
- 2010: Active Lane Keeping Assist and Blind Spot Assist
- 2013: PRE-SAFE® Brake with pedestrian recognition
- 2014: COLLISION PREVENTION ASSIST PLUS
- 2013: DISTRONIC Plus with Drive Assist
- 2016: DRIVE PILOT with Active Lane Change Assist and Emergency Stop Assist
Intelligent Drive: State-of-the-art in automated driving

**Drive Pilot**
- Distance Pilot DISTRONIC
- Steering Pilot
- Active Lane Change Assist
- Active Emergency Stop Assist
- Speed Limit Pilot

**Active Braking Assist**
- Pedestrian Detection
- Cross-Traffic Function
- Congestion Emergency Braking Function

**MULTIBEAM LED Headlights**
- Adaptive High Beam Assist

**PRE-SAFE® PLUS**
- Remote Park-Pilot
- Active Blind Spot Assist
- Evasive Steering Assist
- Attention Assist
- Pre-Safe® Impulse Side
- Pre-Safe® Sound
Active Brake Assist with Cross-Traffic Function and Evasive Steering Assist

- Slower moving or stopping vehicles: 0 – 155 mph
- Standing vehicles: collision avoidance up to 43 mph, reduction of accident severity up to 62 mph
- Pedestrians: collision avoidance up to 37 mph, reduction of accident severity up to 43 mph, Evasive Steering Assist if driver initiates steering maneuver
- Detection of collision danger due to cross-traffic:
  - Situation adaptive boost of driver's braking power, if necessary up to full braking
  - Without driver reaction: autonomous emergency braking
Active Brake Assist with Evasive Steering Assist
Active Brake Assist with Cross-Traffic Function
Intelligent Drive Next Level: DRIVE PILOT

- Distance Pilot DISTRONIC and Steering Pilot at speeds 0 – 130 mph
- DISTRONIC now also reacts to standing vehicles (up to 37 mph)
- Automatic re-start after DISTRONIC standstill for up to 30 s (highway only)
- Even without lane markings, steering support at speeds of up to 80 mph by orientation on surrounding vehicles and parallel structures (swarm)
- Active Lange Change Assist: Steering Pilot stays active during lane changes
- Speed Limit Pilot automatically adapts setting of DISTRONIC to detected speed limits
- More comfortable hands-on detection
- Active Emergency Stop Assist
Active Lane Change Assist

- Comfortable support of lane changes by Steering Pilot
- Initiated by driver: indicator set for more than 2 s
- Clearance of neighboring lane monitored by radar sensors and stereo camera
- Active at speed range 50 – 112 mph on multi-lane roads confirmed by navigation
- During activity the steering icon in the instrument cluster stays green.
  If the system is passive or not available, the icon is displayed in gray.
- Abortion of maneuver if
  - it is not possible within 3 s
  - obstacle is detected in neighboring lane
  - driver countersteers.
Car-to-X Communication

- Expands the range of current sensors and can warn of imminent danger earlier than in-vehicle sensors
- System can automatically exchange (provide and receive) relevant information with other vehicles in the surrounding area via mobile phone technology
- Driver can also send a warning manually
- Enables the car a view around corners and bends or through obstacles
- Warning concept according to situation:
  - Icon in Navigation Display (Live Traffic)
  - Optical warning in Instrument cluster
  - Voice output ahead of source of danger

In combination with COMAND Online and Live Traffic

<table>
<thead>
<tr>
<th>Event</th>
<th>Broken down vehicle</th>
<th>Accident</th>
<th>Hazard lights on</th>
<th>Slip hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icon</td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
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Examples of Warning Functions
Remote Park Pilot
The New E-Class: The Most Intelligent Business Saloon
Partially automated driving, stress relief, autonomous braking

• Partially automated driving on freeways, highways and even in city traffic
  – DRIVE PILOT with Distance Pilot DISTRONIC and Steering Pilot
  – Active Emergency Stop Assist
  – Active Lane Change Assist
  – Speed Limit Pilot

• Autonomous braking in hazardous situations when necessary

• Active assistance with evasive maneuvers

These are just some of the functions of the new and extended Intelligent Drive Driving Assistance package from Mercedes-Benz. The goal is to reduce stress and enhance comfort for the driver, combined with greater safety for all road users.
Further Steps to Higher Automation Levels

<table>
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<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
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<td>No Automation</td>
<td>Assisted (Assistiert)</td>
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<td>Driver has to supervise the automated function continuously.</td>
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Fail safe

Clearly defined regulations and laws

Functional improvements ongoing regularly
### Further Steps to Higher Automation Levels

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<th>Level 4</th>
<th>Level 5</th>
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<tr>
<td>No Automation</td>
<td>Assisted (Assistiert)</td>
<td>Partially Automated (Teilautomatisiert)</td>
<td>Conditionally Automated (Hochautomatisiert)</td>
<td>Highly Automated (Vollautomatisiert)</td>
<td>Fully Automated (Fahrerlos)</td>
</tr>
</tbody>
</table>
| Drivers drives by his own |  | Driver has to supervise the automated function continuously. **Responsibility stays at the driver**  
**No** side activities allowed | System **recognizes its limitations** and hands over the responsibility to the driver early enough.  
**Defined** side activities allowed |  |  |

**Fail safe**  
- Clearly defined regulations and laws

**Fail operational**  
- Regulations and laws under development

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RD/FA  
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level
Safety and Automation: The Major Challenge

Accidents are almost all due to human error

Humans do much more right when driving than they do wrong

We have with some success automated to intervene when people do something wrong.

We now aim at automating those things that people do right.

On the German Autobahn, every 7.5 million km we may catch an error.

We have to drive those 7.5 million km and must not fail a single time.
Further Steps: Automated Driving on Urban and Rural Roads

Difficulty strongly depends on
• traffic situation/environment
• weather
• sensor configuration
Autonomous Cars Allow Extended Individual Mobility for All
Our Main Targets for Automated/Autonomous Driving

Cars in private ownership

• Drive comfortable and safe
• Individual mobility for all
• Extended use of driving time
Next Step: Autonomous Highway-Pilot

- The system takes over longitudinal and lateral control on multi-lane roads with parallel traffic system.
- The driver may perform certain secondary tasks limited to the vehicle’s infotainment/functions that are controlled by us.
- The driver must take over again a certain time frame after a request by the system.
- Until the driver takes over, the system remains in control.
- The system avoids collisions at least as well as a human driver.
- If the driver does not take over the system starts decelerating moderately (Active Emergency Stop Assist) until he takes over or vehicle is stopped.
- Failures by the system are handled by the system.
Nevada Test License

First motor manufacturer to receive a test license for autonomous driving for a series production vehicle.
Pioneers of Intelligent Drive:

First motor manufacturer to demonstrate the feasibility of autonomous driving on both interurban and urban routes
Impression of Bertha Benz Drive: Overland

Few road users, unobstructed view, dedicated lanes
Impression of Bertha Benz Drive: Inner City

Driving around static obstacles with on-coming traffic
F 015 – Luxury in Motion

Mercedes-Benz  RD/FA

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Our Main Targets for Automated/Autonomous Driving

**Cars in private ownership**
- Drive comfortable and safe
- Individual mobility for all
- Extended use of driving time

**Cars for rent and share**
- Bring and return the car to where it is needed
- Use the best purpose car
Autonomous Cars Meet the Drivers Wherever They are Needed
Example: Long-term Vision of Car Sharing
Example: Automated Valet Parking

- Automatically driving to a chosen parking spot in a parking lot or parking garage
- Automated parking
- Driver can leave vehicle at entrance to venue
Our Main Targets for Automated/Autonomous Driving

**Cars in private ownership**
- Drive comfortable and safe
- Individual mobility for all
- Extended use of driving time

**Trucks to deliver goods**
- Extended use of driving time
- Automated loading/switching
- Drive safe and efficient

**Cars for rent and share**
- Bring and return the car to where it is needed
- Use the best purpose car

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Pioneers of Autonomous Trucks

Freightliner Inspiration Truck – the first licensed autonomous driving truck in the US
Example: Automated Depot Driving
First motor manufacturer to demonstrate the feasibility of autonomous driving on both interurban and urban routes.

Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Pioneers of Autonomous Buses

Mercedes-Benz Future Bus with City Pilot: Milestone on the way towards autonomous driving in public transport
On the road to autonomous driving – the best is yet to come!